MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

VOL. XXIV. MAY, 1896. No. 5

INTRODUCTION.

The REVIEW for May, 1896, is based on 2,726 reports from stations occupied by regular and voluntary observers, classified as follows: 149 from Weather Bureau stations; 33 from U. S. Army post surgeons; 2,404 from voluntary observers; 32 from Canadian stations; 1 from Hawaii; 96 received through the Southern Pacific Railway Company; 11 from U. S. Life-Saving stations. International simultaneous observations are received from a few stations and used together with trustworthy newspaper extracts and special reports.

The WEATHER REVIEW is prepared under the general editorial supervision of Prof. Cleveland Abbe. Unless otherwise specifically noted, the text is written by the Editor, but the statistical tables are furnished by Mr. A. J. Henry, Chief of the Division of Records and Meteorological Data. Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada, Mr. Curtis J. Lyons, Meteorologist to the Government Survey, Honolulu, and of Dr. Mariano Bárcena, Director of the Central Meteorological Observatory of Mexico.

CLIMATOLOGY OF THE MONTH.

GENERAL CHARACTERISTICS.

During May the mean temperature was remarkably high in the interior of the South Atlantic States and the Gulf States. The departures were generally from 5° to 10° above the normal. From Lake Superior southward to the Gulf and South Atlantic coasts every station reported that the mean temperature was the highest on record for this month. In contrast with this, the temperature in northern California, Nevada, Oregon, and Washington was very low, and most stations in this region report the mean temperature as the lowest on record for May. Such great contrasts over such large areas assure us that all local influences are insignificant in comparison with the broad features of the general atmospheric circulation. The average distribution of pressure and winds in the lower atmosphere has changed during the present month, as though a stronger northerly wind had brought cooler air and more rain to our northwest Pacific Coast, and as though there was thus produced an unusual eastward flow above the Rocky Mountains and an unusually rapid descent from the summits of the plateau to the valley of the Mississippi. The dynamic warming of the air had less time than usual to be dissipated by radiation, and the unusual rainfall west of the summit of the Rocky Mountains increased the fœhn effect on the eastern slope, so that the temperatures in the Mississippi Valley were higher than usual. On the other hand, the tropical high pressure over the Atlantic invaded the Atlantic States to a greater extent than usual, so that southeast to southwest winds were increased, thus banking up the movement from the Pacific and producing a heavier rain in the Mississippi basin, notwithstanding the higher temperatures of that region. The monthly maps of general distribution of winds and barometric pressure over the globe show that the equatorial belt called doldrums is greatly disturbed in the course of the year by the variable influence of the sun's heat over the continents. In April the doldrums are much nearer the equator than in May, and, in fact, in the latter month, and still more in the subsequent months, the so-called equatorial belt of low pressure moves into rather high northerly latitudes. During these months the low pressure area in the United States belongs to a branch of the equatorial trough that extends from the west coast of Ecuador northwestward to Alberta and beyond. The winds, the moisture, the temperature, and even the cloud forms that prevail over the interior of the United States during April and May, when this barometric condition is being developed, remind us of the conditions that prevail in the corresponding portions of the doldrums. It would, perhaps, be too much to say that the hot weather during May, 1896, was due to heat and moisture brought by southerly winds from the doldrums, and yet the distribution of the pressure was such as harmonizes with increased flow of air from the lower latitudes northward over the eastern part of the United States, and with increased flow of northerly air southward over the Pacific Coast and Rocky Mountain Plateau.

The extensive series of general storms and tornadoes, culminating on May 27 in the disaster at St. Louis, harmonize with the general statement that at this time atmospheric conditions appropriate to the equatorial regions prevailed in the interior States. In connection with this and the other tornadoes of that date, Storm Bulletin No. 4 was published on May 28. A detailed account of the St. Louis tornado, by Mr. H. C. Frankenfield, Local Forecast Official, will be found at pp. 77–81 of the MONTHLY WEATHER REVIEW for March.

ATMOSPHERIC PRESSURE.

[In inches and hundredths.]

The distribution of mean atmospheric pressure reduced to sea level, as shown by mercurial barometers, not reduced to standard gravity, and as determined from observations taken daily at 8 a. m. and 8 p. m. (seventy-fifth meridian time), is shown by isobars on Chart IV. That portion of the reduction

to standard gravity that depends on latitude is shown by the numbers printed on the right-hand border.

The *mean pressures* during the current month were equally high on the south Atlantic and California coasts. The highest were: Bermuda, 30.12; Charleston and Eureka, 30.11; Savannah, Jacksonville, and Jupiter, 30.09; Hatteras, Wilmington, Tampa, and Mobile, 30.08; Atlanta and Key West, 30.07.

The *mean pressures* were low in North and South Dakota, Manitoba, Athabasca, and the adjacent regions. The lowest were: Battleford and Prince Albert, 29.78; Qu'Appelle, Minnedosa, Winnipeg, Moorhead, Miles City, Rapid City, and Elpaso, 29.80; Williston and Huron, 29.81.

As compared with the normal for May, the mean pressure was in excess in both the Atlantic and Pacific Coast regions and was deficient over the Lake Region, Mississippi Valley, and eastern Rocky Mountain Slope. The greatest excesses were: Eureka, 0.09; St. Johns, N. F., Halifax, Hatteras, and Charleston, 0.08; Jacksonville, Jupiter, Mobile, Knoxville, and Fresno, 0.07. The greatest deficits were: Winnipeg, Moorhead, and Rapid City, 0.13; Huron, 0.12; Pierre, Miles City, Concordia, and Marquette, 0.11; Duluth, 0.10.

As compared with the preceding month of April, the pressures, reduced to sea level, show a rise in Oregon, Washington, and Newfoundland, but a fall at all other stations. The greatest rises were: St. Johns, N. F., 0.13; Astoria, 0.12; Tatoosh Island and Port Angeles, 0.10. The greatest falls were: Prince Albert, Winnipeg, White River, 0.17; Ottawa, 0.16; Port Stanley and Moorhead, 0.15; Father Point, Rockliffe, Saugeen, Sault Ste. Marie, and Minnedosa, 0.14.

AREAS OF HIGH AND LOW PRESSURE.

By Prof. H. A. HAZEN.

During May ten low areas and seven high areas have been sufficiently well defined to be traced on Charts I and II, respectively. By comparing Charts I and II side by side, the very interesting contrast is brought out that, in general, the lows mass themselves or are more abundant between the Rocky Mountains and the Mississippi River, where there are almost no highs. On the other hand, the highs are most abundant off the Atlantic Coast, where there are almost no lows.

One of the more remarkable points brought out in Chart I is the disappearance of lows near the center of the country. This is due largely to the prevalence of high pressure off the Atlantic Coast, and also to the weakness of the conditions producing the lows which permitted their rapid filling up.

The accompanying table exhibits some of the more important data of the origin, motion, and velocity of these highs and lows. Very careful attention has been paid to the motion of cirrus clouds in connection with these highs and lows. The manuscript daily cloud maps of the Weather Bureau show every cloud direction that could be observed at telegraph stations, even though the cloud was so small as to be barely visible. This gives an additional advantage to any one studying the motions of clouds. The evidence from these cloud motions shows conclusively that the upper clouds within 500 miles of high and low centers move toward the east, or if they deviate from that direction they coincide very nearly with the surface wind. This is particularly the case in the interior, but on the coast there are several exceptions showing a changing influence from the proximity of the large body of water. The following is a brief summary of each high and low.

HIGH AREAS.

I.—First noted at the mouth of the St. Lawrence a. m. of 1st. Its motion was very slow, due south, and it was last seen a. m. of 5th off the south Atlantic Coast.

II.—The origin and track of high area No. II was precisely similar to No. I. First noted a. m. of 5th and last seen off the southeast coast of Florida p. m. of 11th.

III.—First seen p. m. of 14th in southern Georgia. Its motion was quite circuitous, by Ohio and through eastern North Carolina, south to the east coast of Florida, where it was last noted p. m. of 18th.

IV.—First seen to the north of Montana a. m. of 17th. It moved east and was last seen over Newfoundland a. m. of 22d.

V.—First seen off the middle Pacific Coast a. m. of 19th. Its motion was eastward, reaching Newfoundland a. m. of 26th.

VI.—First noted off the north Pacific Coast a. m. of 26th. It moved east-southeast, and was last seen a. m. of 30th off the North Carolina coast.

VII.—First noted to the north of Montana a. m. of 29th. It moved south-southeast and was still in existence on the last day of the month in Nebraska.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	1, a. m.	50	67	5, a. m.	32	78	1,650	4.0	412	17.2
II	5, a. m.	49	60	11, p. m.	24	79	2,990	6.5	460	19.2
III	14, p. m.	31	84	18, p. m.	26	80	1,960	4.0	490	20.4
IV	17, a. m.	53	116	22, a. m.	48	53	3,520	5.0	704	29.3
V	19, a. m.	41	124	26, a. m.	47	54	4,060	7.0	579	24.1
VI	26, a. m.	46	126	30, a. m.	34	76	2,940	4.0	735	30.6
VII	29, a. m.	51	116	31, p. m.	42	104	1,400	2.5	561	23.4
Sums							18,520	33.0	3,941	
Mean of 7 paths							2,646	4.71	563	23.5
Mean of 33.0 days									561	23.4
Low areas.										
I	1, a. m.	41	93	2, p. m.	50	86	700	1.5	468	19.5
II	3, a. m.	49	122	13, p. m.	53	102	3,430	10.5	326	13.6
III	12, a. m.	37	99	15, a. m.	49	92	1,220	3.0	406	16.9
IV	14, p. m.	33	114	19, a. m.	47	59	3,240	4.5	720	30.0
V	17, a. m.	40	104	19, a. m.	41	83	1,210	2.0	606	25.2
VI	17, p. m.	32	113	30, p. m.	36	97	1,340	3.0	446	18.6
VII	19, a. m.	51	122	23, a. m.	48	53	3,230	4.0	808	33.7
VIII	21, p. m.	52	119	27, a. m.	49	67	2,440	5.5	443	18.5
IX	26, p. m.	41	104	30, a. m.	46	76	1,780	3.5	509	21.2
X	27, p. m.	32	113	31, p. m.	36	93	1,370	4.0	343	14.3
Sums							19,960	41.5	5,075	
Mean of 10 paths									507	21.1
Mean of 41.5 days									481	20.0

LOW AREAS.

I.—This was noted on a. m. of 1st, in Iowa. Its track could be followed only 1.5 day, and it disappeared to the north of Lake Superior p. m. of 2d.

II.—Was first noted on the north Pacific Coast a. m. of 3d; its motion was first southeast to Nebraska and Kansas. It had a remarkable persistence in the region just east of the Rocky Mountains; it finally disappeared to the north of Montana p. m. of 13th. It was traced for 10.5 days, which gives a very long life to this low.

III.—This was first seen in south Kansas a. m. of 12th; its motion was nearly due north and it was last noted a. m. of 15th to the northwest of Lake Superior.

IV.—During the month of May there were three remarkable cases of low areas taking their origin in Arizona, viz, the present one, and Nos. VI and X. In their place of origin these lows did not display much activity, though it can not be doubted that the disturbance came from Arizona. This storm, IV, moved in a northeast direction, and disappeared over Newfoundland a. m. of 19th.

V.—Was first seen in Colorado a. m. of 17th. Its track was eastward, and it filled up in Ohio a. m. of 19th.